

[54] **TOTALLY INTERNALLY REFLECTING THIN, FLEXIBLE FILM**

[75] Inventor: Sanford Cobb, Jr., St. Mary's Point, Minn.

[73] Assignee: Minnesota Mining and Manufacturing Company, Saint Paul, Minn.

[21] Appl. No.: 472,621

[22] Filed: Jan. 30, 1990

Related U.S. Application Data

[63] Continuation of Ser. No. 218,087, Jul. 12, 1988, Pat. No. 4,906,070, which is a continuation of Ser. No. 903,655, Sep. 5, 1986, abandoned, which is a continuation-in-part of Ser. No. 799,869, Nov. 21, 1985, abandoned, and a continuation-in-part of Ser. No. 819,118, Jan. 15, 1986, abandoned.

[51] Int. Cl.⁵ G02B 5/04; G02B 5/124; G02B 5/136
[52] U.S. Cl. 359/831; 359/528; 359/546
[58] Field of Search 350/286, 287, 276 R, 350/616, 176, 167, 103, 104, 106, 109; 362/32, 339, 337

References Cited

U.S. PATENT DOCUMENTS

2,175,067 10/1939 Rolph 240/106
2,218,227 10/1940 Winnek 13/61
2,232,551 2/1941 Merton 18/57
2,248,638 7/1941 Merton 156/10
2,279,555 4/1942 Browne et al. 88/24
2,723,919 11/1955 Pohnan 117/35
3,288,990 11/1966 Stahlhut 240/106
3,689,346 9/1972 Rowland 156/245
3,908,056 9/1975 Anderson 428/142
4,118,763 10/1978 Osteen 362/339

4,120,565 10/1978 Rabi et al. 350/286
4,154,219 5/1979 Gupta et al. 126/270
4,235,515 11/1980 Sheiman et al. 350/138
4,244,683 1/1981 Rowland 425/143
4,260,220 4/1981 Whitehead 350/96.28
4,389,085 6/1983 Mori 350/96.10
4,422,719 12/1983 Orcutt 350/96.30
4,466,697 8/1984 Daniel 350/96.30
4,497,860 2/1985 Brady, Jr. 428/156
4,576,850 3/1986 Martens 428/156
4,615,579 10/1986 Whitehead 350/96.1

FOREIGN PATENT DOCUMENTS

2127344 4/1964 United Kingdom

Primary Examiner—Bruce Y. Arnold

Assistant Examiner—James Phan

Attorney, Agent, or Firm—Gary L. Griswold; Walter N. Kirn; Stephen W. Buckingham

ABSTRACT

A thin, flexible film made of a transparent polymeric material including a structured surface and an opposite smooth surface, wherein light striking either surface, within certain angular ranges, is totally internally reflected. The structured surface includes a linear array of miniature substantially right angled isosceles prisms arranged side-by-side to form a plurality of peaks and grooves. In addition, the perpendicular sides of the prisms make an angle of approximately 45° with the smooth surface, and when the film is curled the smooth surface lies in a smooth continuous arcuate curve without materially affecting the performance of the film. Because of the film's flexibility and its ability to totally internally reflect light, it may be utilized in a variety of ways, for example, as a collector of solar energy or as a light conduit. The performance of the film may be manipulated to permit controlled light leakage.

8 Claims, 4 Drawing Sheets

